

CLAIMS

What is claimed is:

- 5 1. An integrated circuit die comprising:
a copper contact;
a coating on the copper contact, the coating including a material formed from a reaction
of an organic material with copper oxide.
2. The integrated circuit die of claim 1 wherein the coating is formed by exposing
the copper contact to a solution that includes the organic material.
- 10 3. The integrated circuit of claim 2 wherein the solution has a pH level of at least 7.
4. The integrated circuit of claim 3 wherein the solution has a pH level of at least
7.5.
5. The integrated circuit of claim 1 wherein the organic material includes molecules
having nitrogen-hydrogen bonds.
- 15 6. The integrated circuit of claim 1 wherein the organic material includes
benzotriazole.
7. The integrated circuit of claim 1 wherein the organic material includes at least one
of tolyltriazole, imidazoles, benzoimidazoles, polyaniline, and polyimidazoles.
- 20 8. The integrated circuit die of claim 1 further comprising:
a plurality of interconnect layers including a final copper interconnect layer;
an insulating layer overlying the interconnect layers;
wherein the copper contact is located in the final copper layer and is accessible by an
opening in the insulating layer.

9. The integrated circuit die of claim 8 wherein the coating is located in the opening in the insulating layer.

10. The integrated circuit of claim 1 wherein the copper contact is a wire bond pad.

5 11. The integrated circuit of claim 1 wherein the coating has a thermal resistance of 100 C or greater.

12. The integrated circuit of claim 1 wherein the coating has a thickness of 150 Angstrom or less.

13. The integrated circuit of claim 1 wherein the coating has a thickness in the range of 20-50 Angstroms.

10 14. The integrated circuit of claim 1 wherein the coating has a thickness of 50 Angstroms or less.

15 15. An integrated circuit package including the integrated circuit die of claim 1 and further comprising:

a package substrate, the integrated circuit die attached to the packaged substrate;

15 a wire connected to the copper contact and connected to a contact of the package substrate.

16. A method for making an integrated circuit, the method comprising:
forming a coating on a copper contact of an integrated circuit die by exposing the copper
contact to a solution having a pH level of 7 or greater and including an organic
20 material.

17. The method of claim 16 further comprising:
bonding a wire to the copper contact after the forming.

18. The method of claim 17 wherein the bonding the wire to the copper contact is performed at 100 C or above.

19. The method of claim 17 further comprising:
plasma cleaning an exposed surface of the coating after the forming the coating and prior
5 to the bonding the wire.

20. The method of claim 17 wherein the bonding removes at least a portion of the coating layer directly underneath the wire.

21. The method of claim 16 wherein the solution has a pH level of 7.5 or greater.

22. The method of claim 16 further comprising:
10 pretreating the copper contact with an acid prior to the forming the coating.

23. The method of claim 16 wherein the organic material is reactive with copper oxide, wherein the coating includes a material formed from the reaction of the organic material with copper oxide.

24. The method of claim 23 wherein the organic material includes molecules having
15 nitrogen-hydrogen bonds.

25. The method of claim 23 wherein the organic material includes benzotriazole.

26. The method of claim 23 wherein the organic material includes at least one of tolyltriazole, imidazoles, benzoimidazoles, polyaniline, and polyimidazoles.

27. The method of claim 16 wherein the forming the coating further includes:
20 dipping a wafer including the integrated circuit die into the solution for at least 5 minutes.

28. Method for making an integrated circuit, the method comprising:
forming a coating on a copper contact;

plasma cleaning an exposed surface of the coating after the forming the coating;
bonding a wire to the copper contact after the plasma cleaning.

29. The method of claim 28 wherein the plasma cleaning further includes subjecting the exposed surface of the coating to a gas mixture including at least one of argon and helium.

5 30. The method of claim 28 wherein the bonding the wire to the copper contact is performed at 100 C or above.

31. The method of claim 28 wherein the bonding removes at least a portion of the coating layer directly underneath the wire.

10 32. The method of claim 28 wherein the solution includes an organic material that is reactive with copper oxide, wherein the coating includes a material formed from the reaction of the organic material with copper oxide.

33. The method of claim 32 wherein the organic material includes molecules having nitrogen-hydrogen bonds.

34. The method of claim 32 wherein the organic material includes benzotriazole.

15 35. The method of claim 32 wherein the organic material includes at least one of tolyltriazole, imidazoles, benzoimidazoles, polyaniline, and polyimidazoles.

36. The method of claim 28 further comprising:
singulating a die including the copper contact from a wafer after the forming the coating
and before the plasma etching.

20 37. The method of claim 28 wherein the copper contact is a wire bond pad.

38. The method of claim 28 further comprising:
pretreating the copper contact with an acid prior to the forming the coating.

39. An integrated circuit die comprising:
a plurality of copper bond pads;
a coating on each of the plurality of copper bond pads, the coating formed from exposing
the copper bond pads to a solution that includes an organic material, the organic
material includes molecules having nitrogen hydrogen bonds, the coating includes
a material formed from a reaction of the organic material with copper oxide, the
coating has a thickness of 150 angstroms or less.

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